Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004

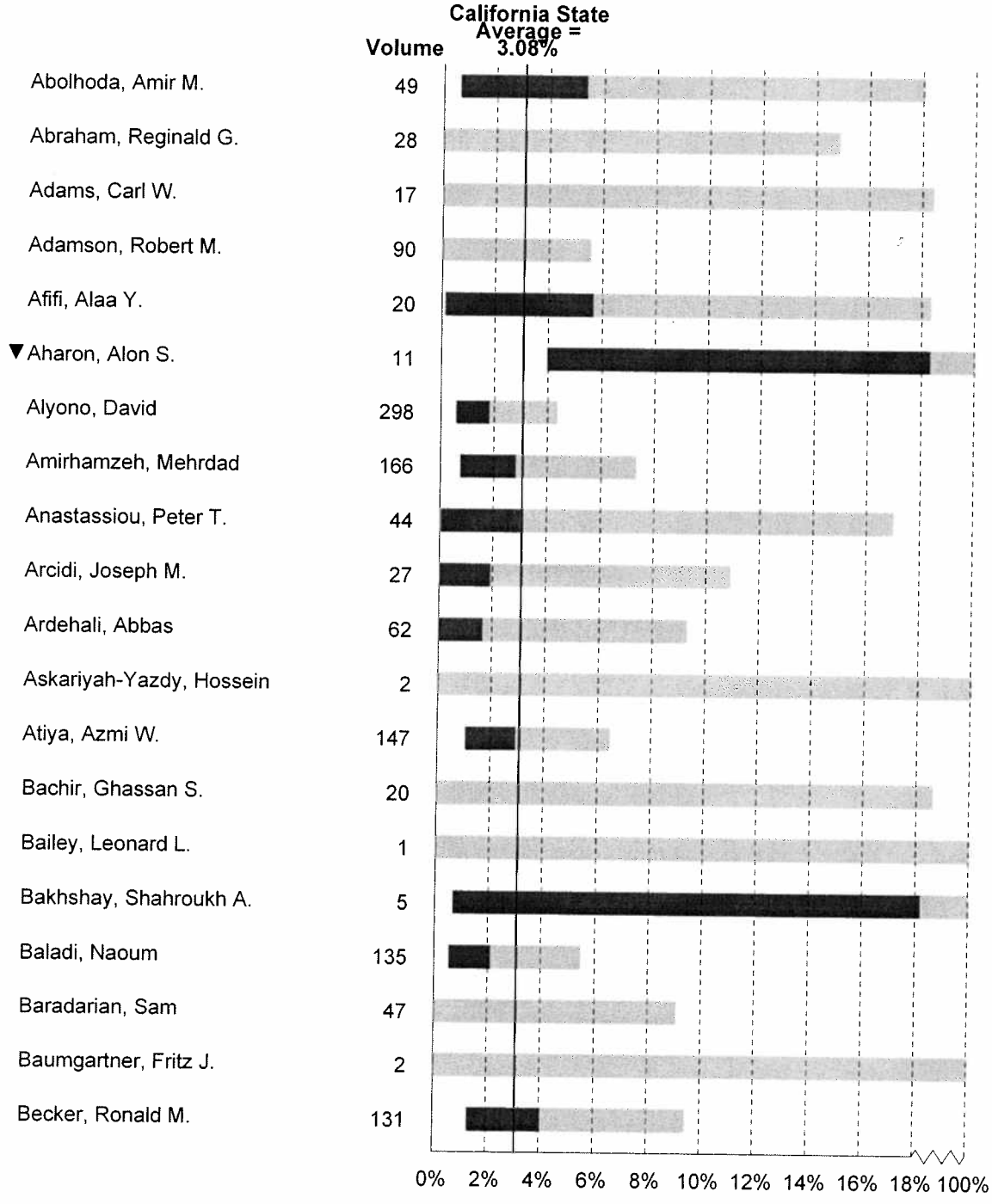


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

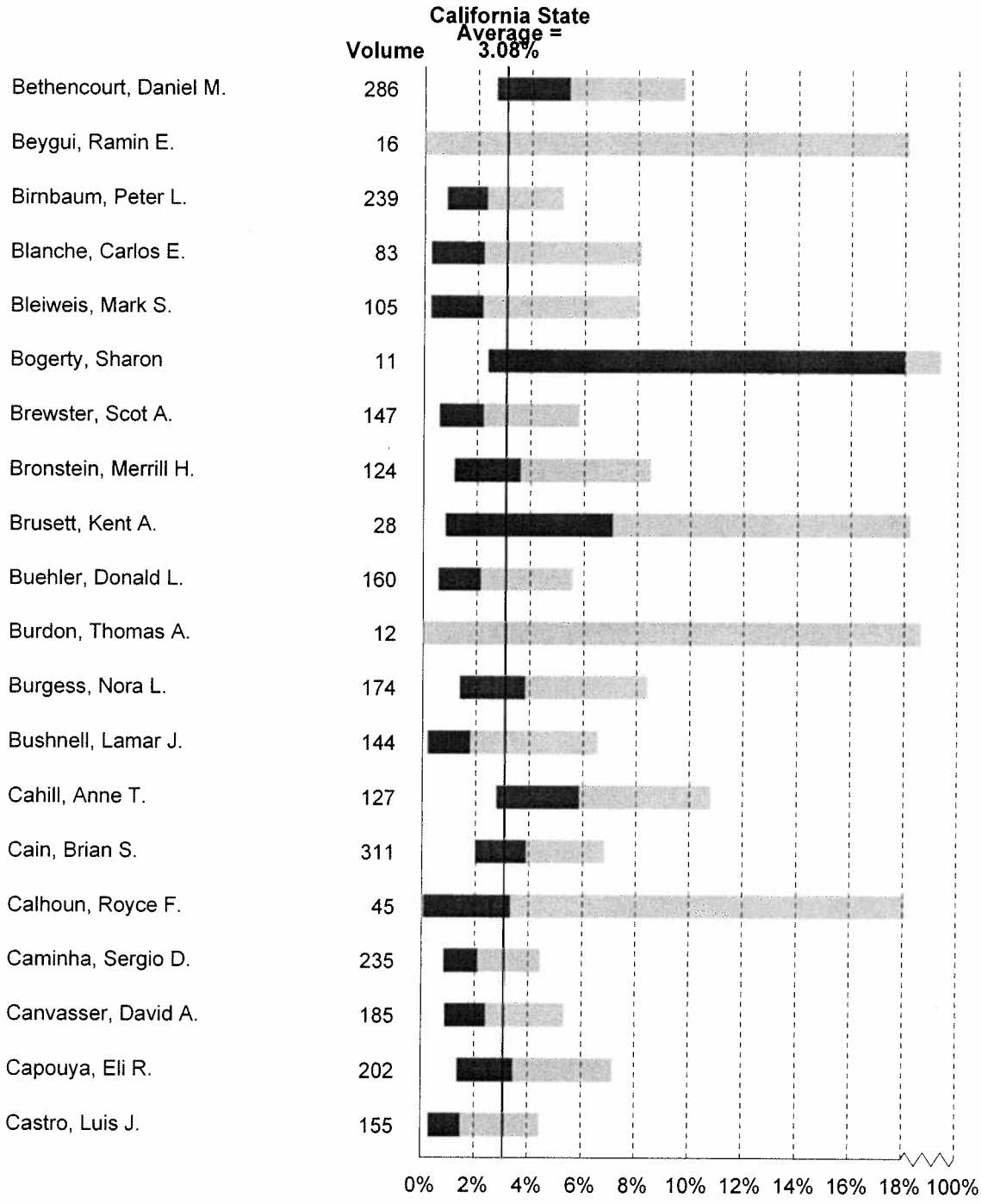


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

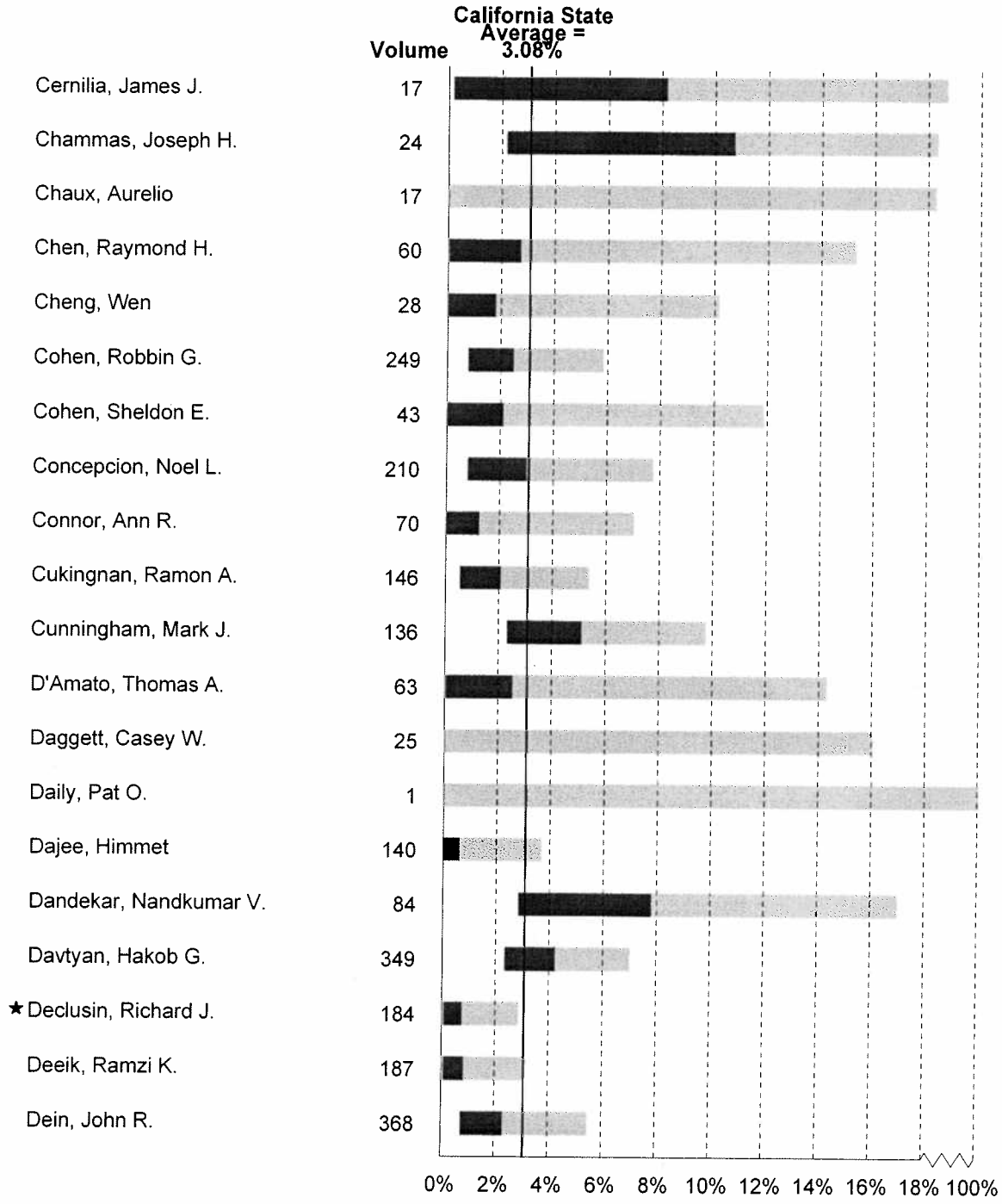


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

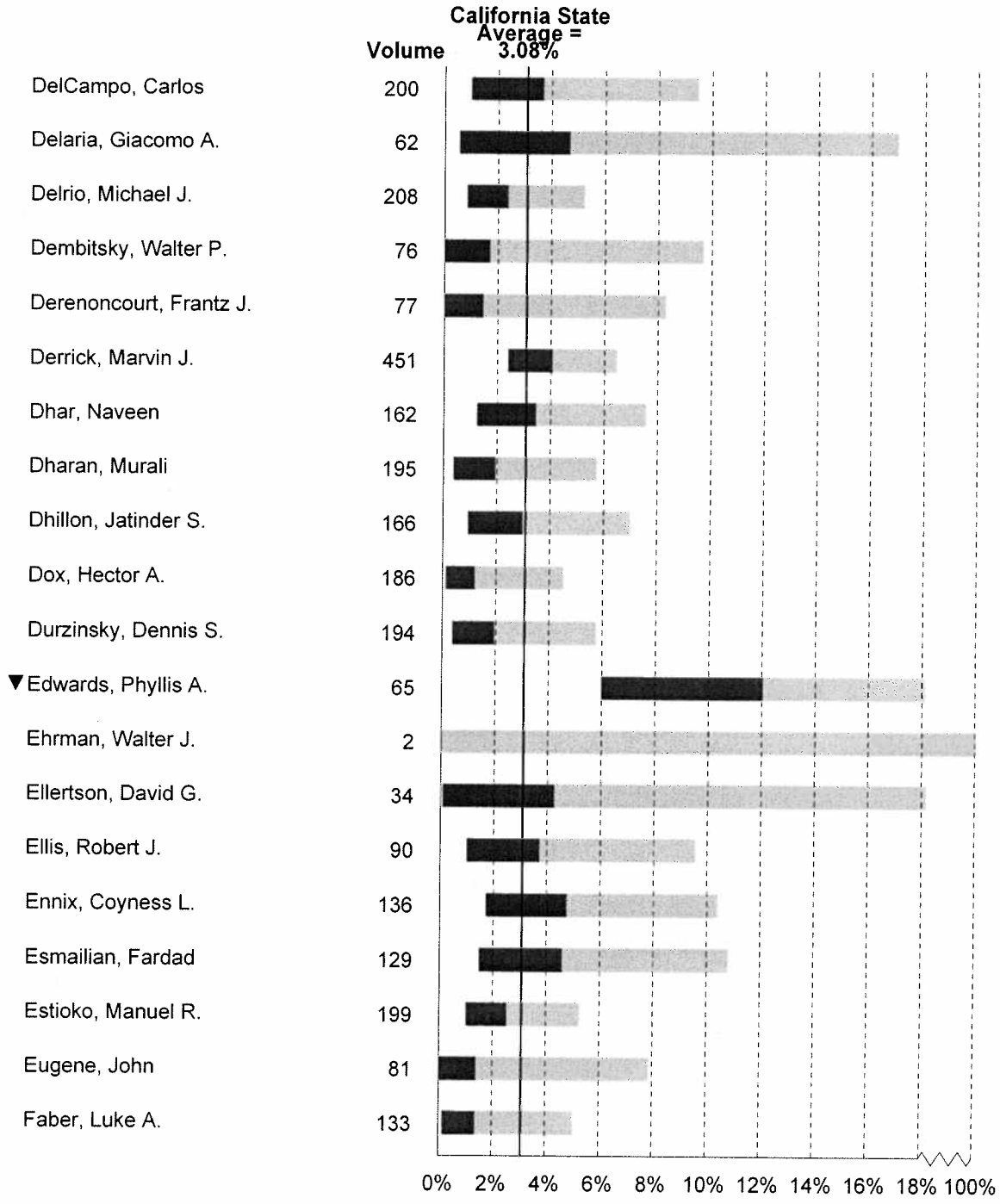


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

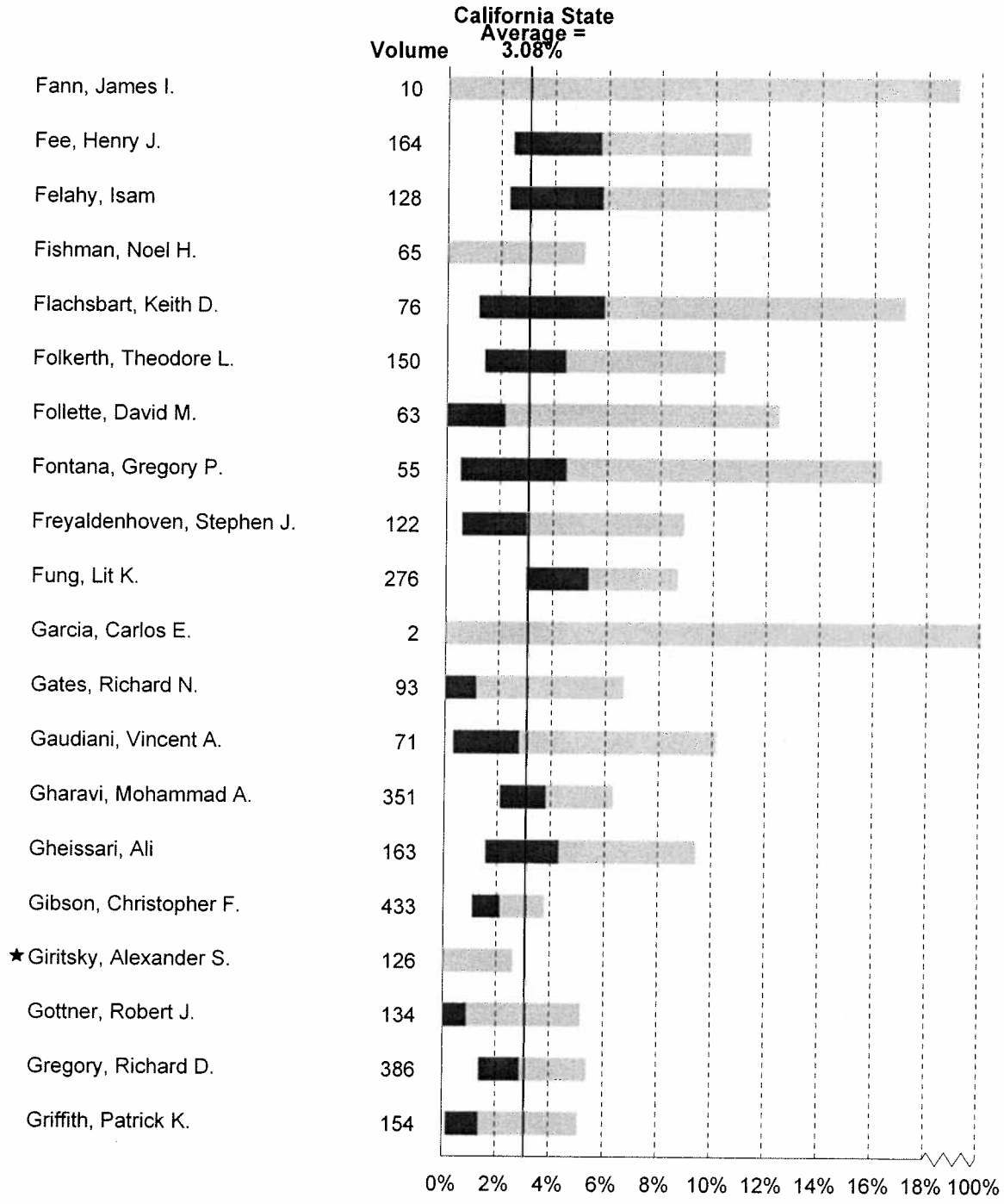


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

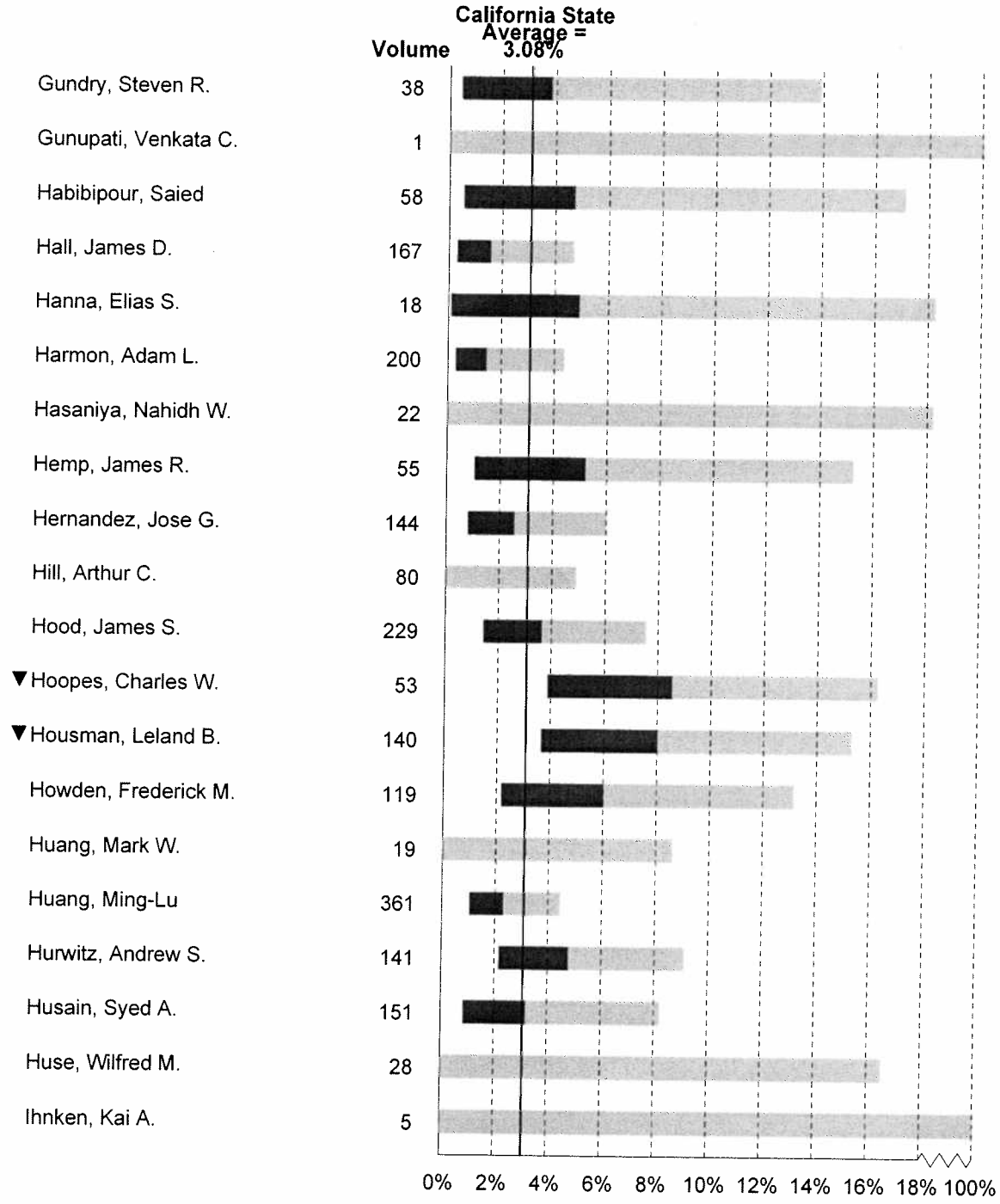


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

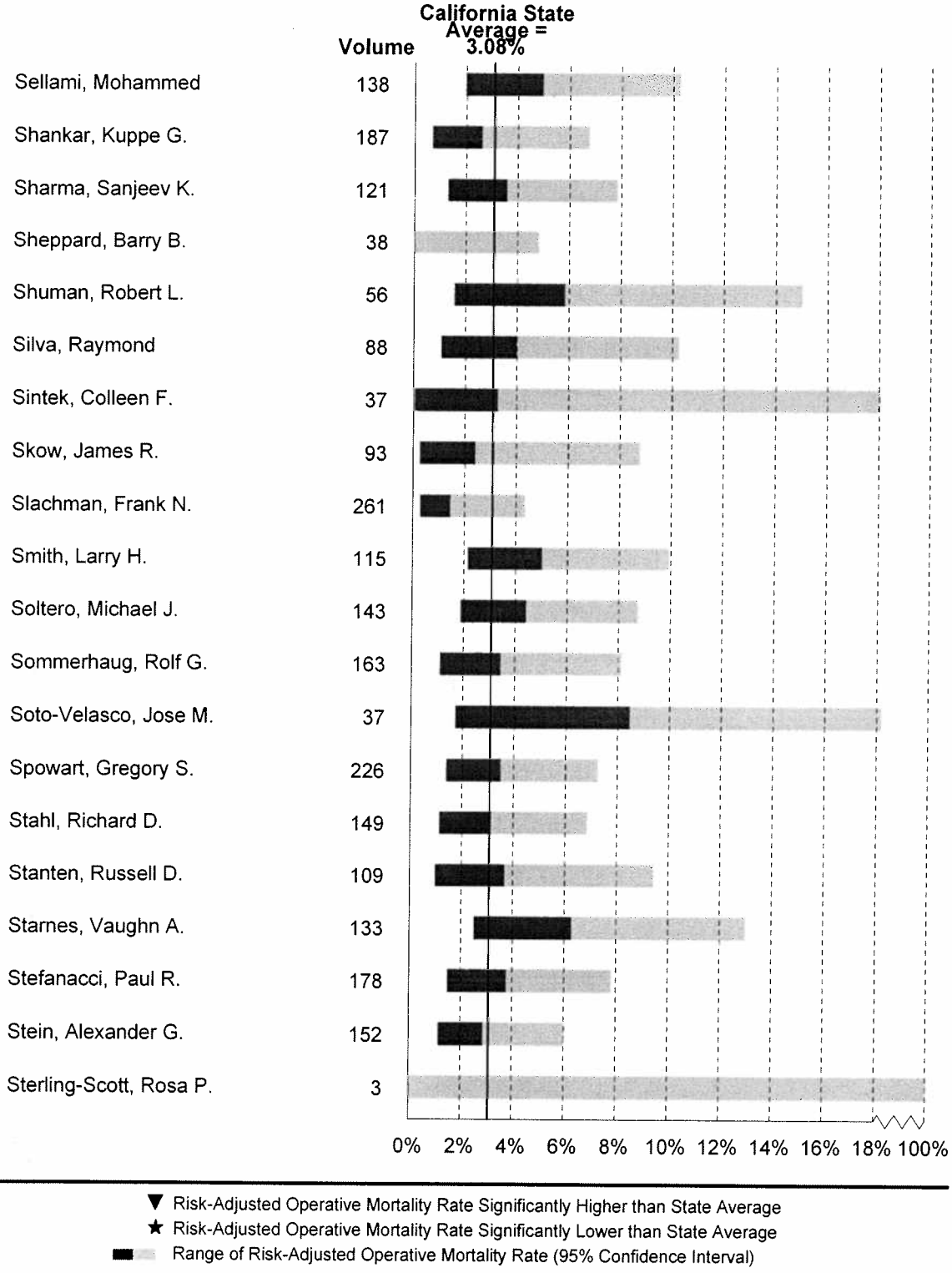


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

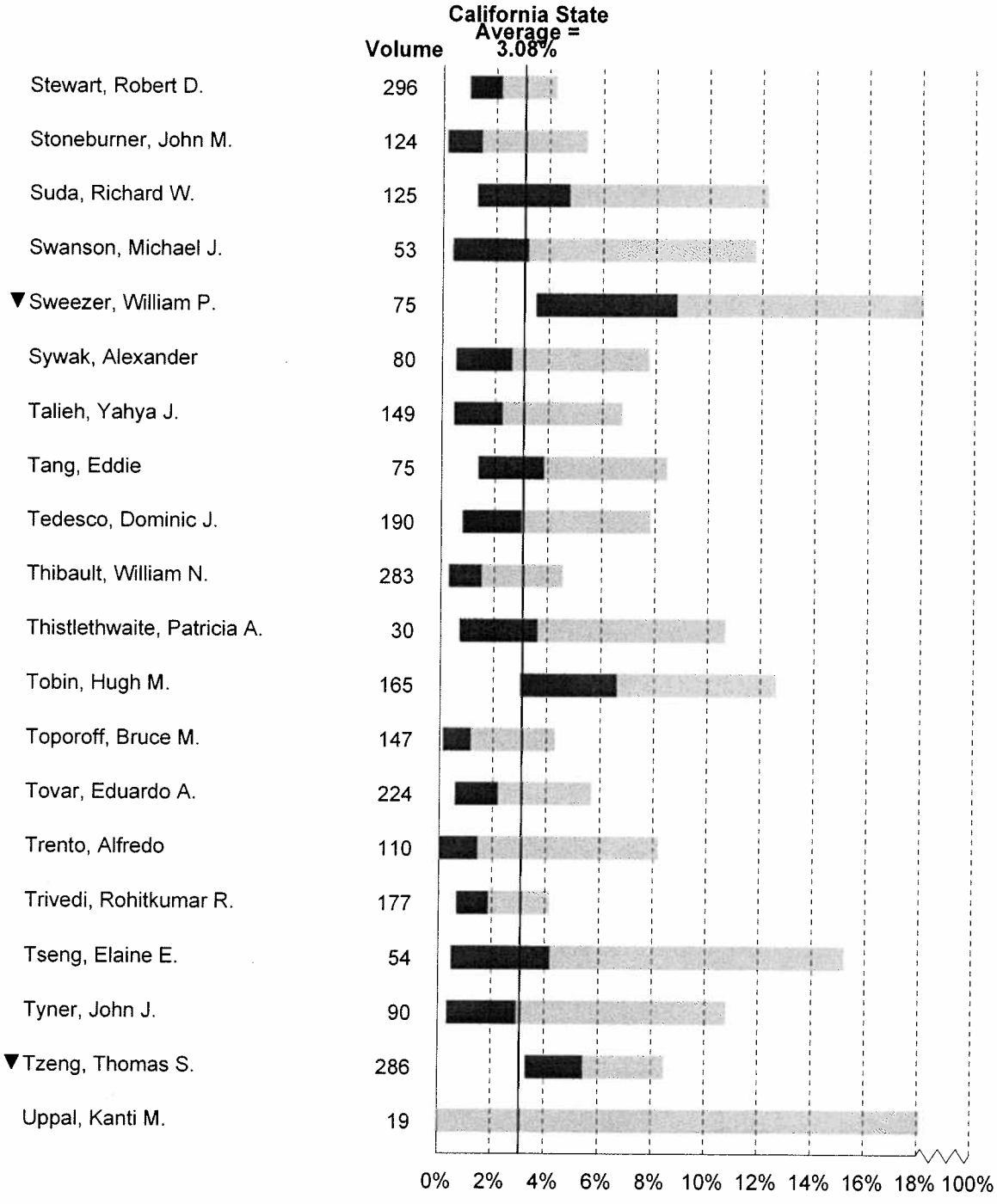


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)

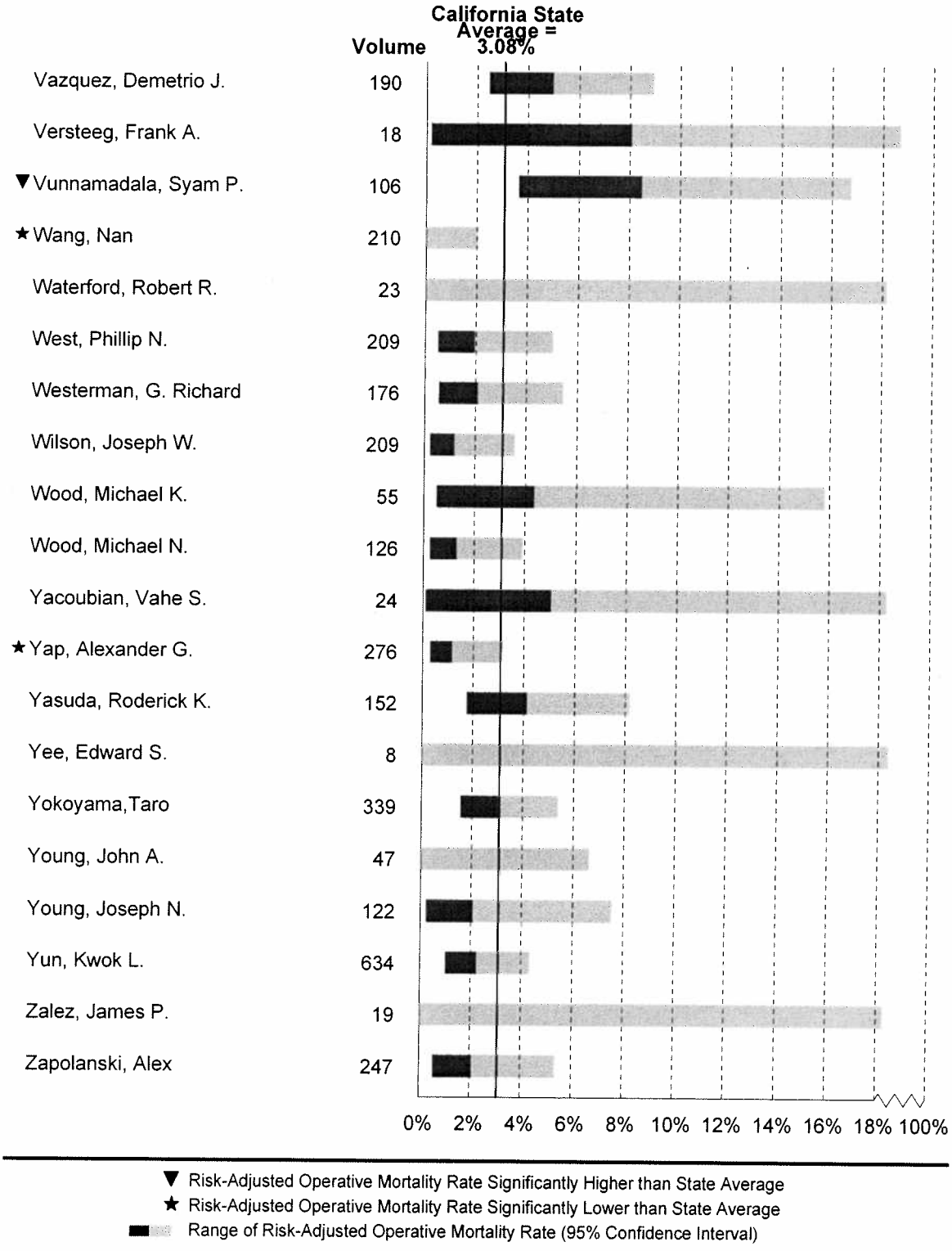
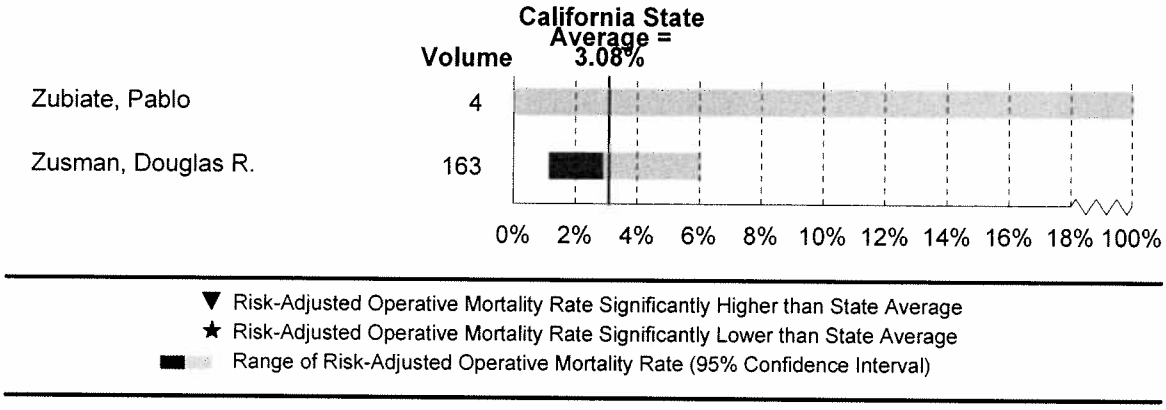


Figure 2: Surgeon Risk-Adjusted Operative Mortality Results, 2003-2004 (cont'd)



VI. 2003-2004 INTERNAL MAMMARY ARTERY USAGE BY HOSPITAL: A PROCESS MEASURE OF QUALITY

A widely accepted definition of healthcare quality regards quality as having three dimensions: process, structure, and outcomes.[12] In the past, OSHPD has focused on the outcome of mortality in its public reporting. Risk-adjusted mortality rates provide a benchmark for provider performance comparison and can be used for investigation of internal processes and structures that contribute to high rates. However, benchmarking processes of care provides a more immediate path to improvement in patient care since it involves measurement of the care patients actually receive. If diagnostic and therapeutic strategies with clear links to outcome are monitored, some quality problems can be detected long before demonstrable outcome differences occur.

In most cases of first-time isolated CABG surgery where the operative status is elective or urgent, the surgeon has the option of using the internal mammary artery (IMA, also known as the internal thoracic artery) The IMA and especially the left IMA is considered the preferred conduit for CABG surgery of the left anterior descending (LAD) coronary artery. A number of healthcare quality advocates recommend public reporting of IMA usage rates for CABG surgery.

Currently, the Leapfrog Evidence-Based Hospital Referral program endorses 80% hospital adherence to IMA use. The National Quality Forum does not endorse a specific rate but states that the goal is to raise the rate of hospitals with low utilization. The Society of Thoracic Surgeons states that the IMA should be given primary consideration in every CABG surgery patient.

Table 6 provides hospital results for IMA use for during 2003-2004. Only first-time isolated CABG surgeries, where the operative status is elective or urgent, are included for IMA usage computation. A low rating indicates that a hospital had less than 70.9% IMA utilization (2 standard deviations (0.095 x 1.96) below the hospital statewide average IMA usage rate of 89.56%). No high ratings were provided since there is no consensus on what constitutes an optimal rate of usage.

The clinical literature strongly supports use of the IMA to promote long-term graft patency and patient survival, but recent research also suggests a reduction in immediate, operative mortality associated with use of the internal mammary artery as opposed to saphenous vein revascularization[13]. Multivariable analyses performed by CCORP also confirmed use of the IMA as an independent predictor of operative survival for first-time isolated CABG surgery patients whose status was not emergent. In addition, there is a negative correlation between hospital risk-adjusted operative mortality rates (r=-0.14, p=0.13), and IMA usage rates which, while not significant, points in the expected causal direction, where hospitals with lower mortality rates have higher IMA usage rates on average.

---

[12] Donabedian A. Evaluating the Quality of Medical Care. The Milbank Quarterly, Vol 83, No.4, 2005 (pp. 691-729).

[13] Ferguson TB Jr, Coombs LP, Peterson ED. Internal thoracic artery grafting in the elderly patient undergoing coronary artery bypass grafting: room for process improvement? J Thoracic Cardiovascular Surgery 2002: 123(5): 869-80.

GUIDE TO INTERPRETING IMA USAGE RESULTS

Isolated CABG surgeries	Includes only first-time isolated CABG surgeries where the operative status was elective or urgent. This number will generally be smaller than the total isolated CABG cases performed by the hospital.
IMA Usage Rate	The ratio of the number of CABG surgeries with IMA grafts (including left IMA, right IMA and bilateral IMA) and selected first-time isolated CABG cases multiplied by 100: Percent IMA use = (Number of IMA grafts used for first-time isolated CABG surgeries/Number of first-time isolated CABG cases) x 100.
Rating	A blank rating indicates that the IMA Usage Rate is acceptable. A Low rating indicates that the IMA Usage Rate for a hospital is less than 70.9%, i.e., two standard deviations (0.095 x 1.96) below the hospital statewide average IMA use rate (89.56%). No high ratings are provided since there is no consensus on what constitutes an optimal rate of usage.

Table 6: Hospital Results for Usage of the Internal Mammary Artery by Region, 2003-2004

Region	Hospital	Isolated CABG surgeries*	IMA Usage Rate	Rating**
State		**35,960**	**89.56%**	
Sacramento Valley & Northern California Region	Enloe Medical Center	315	90.48%	
	Mercy General Hospital	1,529	95.62%	
	Mercy Medical Center - Redding	386	98.96%	
	Mercy San Juan Hospital	218	96.79%	
	Redding Medical Center	30	90.00%	
	Rideout Memorial Hospital	296	98.99%	
	St. Joseph Hospital - Eureka	133	87.22%	
	Sutter Memorial Hospital	1,011	93.18%	
	UC Davis Medical Center	251	94.82%	
San Francisco Bay Area & San Jose	Alta Bates Summit Medical Center - Summit Campus	1,375	97.16%	
	California Pacific Medical Center - Pacific Campus	200	92.50%	
	Doctors Medical Center - San Pablo Campus	100	97.00%	
	Dominican Hospital	164	96.95%	
	El Camino Hospital	164	88.41%	
	Good Samaritan Hospital - San Jose	341	99.41%	
	John Muir Medical Center	152	87.50%	
	Kaiser Foundation Hospital (Geary San Francisco)	1,344	93.38%	
	Marin General Hospital	92	94.57%	
	Mt. Diablo Medical Center	365	87.95%	
	O'Connor Hospital	188	86.17%	
	Mills-Peninsula Health Center	121	91.74%	
	Queen of the Valley Hospital	297	96.63%	
	Salinas Valley Memorial Hospital	382	91.10%	
	San Jose Medical Center	75	70.67%	Low
	San Ramon Regional Medical Center	95	95.79%	
	Santa Clara Valley Medical Center	98	98.98%	
	Santa Rosa Memorial Hospital	178	91.01%	
	Sequoia Hospital	199	98.49%	
	Seton Medical Center	414	92.51%	
	St. Helena Hospital	287	86.06%	
	St. Mary's Medical Center, San Francisco	118	94.07%	
	Stanford University Hospital	217	91.71%	
	Sutter Medical Center of Santa Rosa	225	61.33%	Low

* Only includes first-time isolated CABG surgeries where the operative status was elective or urgent.
** Low rank: IMA Usage Rate for a hospital is less than 70.9%, i.e., two standard deviations (0.095 x 1.96) below the hospital statewide average IMA usage rate (89.56%).

Table 6: Hospital Results for Usage of the Internal Mammary Artery by Region, 2003-2004

Region	Hospital	Isolated CABG surgeries*	IMA Usage Rate	Rating**
State		**35,960**	**89.56%**	
San Francisco Bay Area & San Jose (continued)	UCSF Medical Center	247	89.88%	
	Washington Hospital - Fremont	261	92.34%	
Central California	Bakersfield Heart Hospital	332	93.67%	
	Bakersfield Memorial Hospital	453	89.85%	
	Community Medical Center - Fresno	388	90.46%	
	Dameron Hospital	111	81.08%	
	Doctors Medical Center - Modesto Campus	654	89.60%	
	Fresno Heart Hospital	239	95.82%	
	Kaweah Delta Hospital	644	94.88%	
	Marian Medical Center	196	93.37%	
	Memorial Medical Center of Modesto	496	72.98%	
	San Joaquin Community Hospital	191	90.58%	
	St. Agnes Medical Center	674	87.24%	
	St. Joseph's Medical Center of Stockton	439	86.79%	
San Fernando Valley, Antelope Valley, Ventura & Santa Barbara	Antelope Valley Hospital Medical Center	81	76.54%	
	Community Memorial Hospital of San Buenaventura	302	99.67%	
	Encino Tarzana Regional Medical Center	205	93.17%	
	French Hospital Medical Center	113	92.92%	
	Glendale Adventist Medical Center - Wilson Terrace	250	97.20%	
	Glendale Memorial Hospital and Health Center	285	95.09%	
	Granada Hills Community Hospital	24	66.67%	Low
	Lancaster Community Hospital	31	54.84%	Low
	Los Robles Regional Medical Center	230	96.52%	
	Northridge Hospital Medical Center	157	98.09%	
	Providence Holy Cross Medical Center	161	93.79%	
	Providence St. Joseph Medical Center	147	95.92%	
	Santa Barbara Cottage Hospital	369	94.31%	
	Sierra Vista Regional Medical Center	163	98.16%	
	St. John's Regional Medical Center	301	98.34%	
	Valley Presbyterian Hospital	58	56.90%	Low

* Only includes first-time isolated CABG surgeries where the operative status was elective or urgent.
** Low rank: IMA Usage Rate for a hospital is less than 70.9%, i.e., two standard deviations (0.095 x 1.96) below the hospital statewide average IMA usage rate (89.56%).

Table 6: Hospital Results for Usage of the Internal Mammary Artery by Region, 2003-2004

Region	Hospital	Isolated CABG surgeries*	IMA Usage Rate	Rating**
State		**35,960**	**89.56%**	
San Fernando Valley, Antelope Valley, Ventura & Santa Barbara (continued)	West Hills Regional Medical Center	80	100.00%	
Greater Los Angeles	Beverly Hospital	51	84.31%	
	Brotman Medical Center	55	98.18%	
	Cedars Sinai Medical Center	355	99.72%	
	Centinela Hospital Medical Center	176	89.20%	
	Citrus Valley Medical Center - IC Campus	277	79.42%	
	Downey Regional Medical Center	134	79.10%	
	Garfield Medical Center	186	81.72%	
	Good Samaritan Hospital - Los Angeles	462	83.98%	
	Huntington Memorial Hospital	258	87.21%	
	Kaiser Foundation Hospital (Sunset Los Angeles)	1,848	96.70%	
	Lakewood Regional Medical Center	240	90.83%	
	Little Company of Mary Hospital	148	95.95%	
	Long Beach Memorial Medical Center	581	90.88%	
	Los Angeles Co Harbor - UCLA Medical Center	234	90.17%	
	Los Angeles Co USC Medical Center	219	81.28%	
	Methodist Hospital of Southern California	199	88.44%	
	Presbyterian Intercommunity Hospital	148	58.78%	Low
	Santa Monica - UCLA Medical Center	58	96.55%	
	St. Francis Medical Center	159	78.62%	
	St. John's Hospital and Health Center	124	93.55%	
	St. Mary Medical Center	118	84.75%	
	St. Vincent Medical Center	335	96.72%	
	Torrance Memorial Medical Center	231	99.13%	
	UCLA Medical Center	165	98.79%	
	USC University Hospital	172	81.98%	
	White Memorial Medical Center	205	86.34%	
Inland Empire, Riverside & San Bernardino	Desert Regional Medical Center	282	98.23%	
	Eisenhower Memorial Hospital	372	94.89%	
	Loma Linda University Medical Center	543	90.06%	

* Only includes first-time isolated CABG surgeries where the operative status was elective or urgent.
** Low rank: IMA Usage Rate for a hospital is less than 70.9%, i.e., two standard deviations (0.095 x 1.96) below the hospital statewide average IMA usage rate (89.56%).

Table 6: Hospital Results for Usage of the Internal Mammary Artery by Region, 2003-2004

Region	Hospital	Isolated CABG surgeries*	IMA Usage Rate	Rating**
State		**35,960**	**89.56%**	
Inland Empire, Riverside & San Bernardino (continued	Pomona Valley Hospital Medical Center	253	93.28%	
	Riverside Community Hospital	390	89.23%	
	San Antonio Community Hospital	108	80.56%	
	St. Bernardine Medical Center	891	92.37%	
	St. Mary Regional Medical Center	389	88.69%	
Orange County	Anaheim Memorial Medical Center	434	87.10%	
	Fountain Valley Regional Hospital	237	83.54%	
	Hoag Memorial Hospital Presbyterian	383	84.07%	
	Irvine Regional Hospital and Medical Center	65	93.85%	
	Mission Hospital Regional Medical Center	354	99.44%	
	Saddleback Memorial Medical Center	212	97.17%	
	St. Joseph Hospital - Orange	286	98.60%	
	St. Jude Medical Center	339	61.36%	Low
	UC Irvine Medical Center	143	94.41%	
	West Anaheim Medical Center	48	70.83%	Low
	Western Medical Center - Santa Ana	198	90.91%	
	Western Medical Center Hospital - Anaheim	306	75.82%	
Greater San Diego	Alvarado Hospital Medical Center	169	96.45%	
	Palomar Medical Center	236	88.98%	
	Scripps Green Hospital	226	94.69%	
	Scripps Memorial Hospital - La Jolla	700	78.14%	
	Scripps Mercy Hospital	247	97.17%	
	Sharp Chula Vista Medical Center	399	74.69%	
	Sharp Grossmont Hospital	304	90.79%	
	Sharp Memorial Hospital	299	89.63%	
	Tri - City Medical Center	228	92.11%	
	UCSD Medical Center	58	100.00%	
	UCSD Medical Center - La Jolla	81	93.83%	
	UCSD Medical Center - La Jolla	81	93.83%	

* Only includes first-time isolated CABG surgeries where the operative status was elective or urgent.
** Low rank: IMA Usage Rate for a hospital is less than 70.9%, i.e., two standard deviations (0.095 x 1.96) below the hospital statewide average IMA usage rate (89.56%).

VII. THE RELATIONSHIP BETWEEN CORONARY ARTERY BYPASS GRAFT SURGERY VOLUME AND OUTCOMES

The "volume-outcome" association refers to the relationship between the quantity of care that a hospital or physician provides and the quality of care that patients receive. In general, researchers have found that the higher the number of patients a hospital or physician treats with a specific condition, the better, on average, are the patients' health outcomes. This volume-outcome relationship has been extensively studied for patients receiving coronary artery bypass graft (CABG) surgery. While most studies have found that hospitals and surgeons performing more CABG surgeries have better outcomes, more recent data and analyses are less consistent in their support of a clinically relevant relationship.[14,15,16] Further, in the previous CCORP report (February 2006), no relationship was found between hospital CABG surgery volume and risk-adjusted CABG surgery mortality.[17] This is possibly because CABG surgery mortality has declined overall in recent years and the procedure has become more standardized based on practice guidelines.

CCORP 2003-2004 Provider Volume-Outcome Analyses

The following analyses were conducted to examine the hospital and surgeon volume-outcome relationship in CABG surgery using the combined CCORP data from 2003 and 2004. The primary goal of these analyses is to use the most current methodological techniques to determine whether hospitals and surgeons performing more procedures have lower risk-adjusted operative mortality than hospitals and surgeons performing fewer procedures in California.

To accomplish this, a patient-level risk-adjusted mortality prediction model was first developed using a hierarchical or multi-level technique. Hierarchical models are increasingly used in health services research to analyze multi-level data, particularly when analyses are intended to assess the impact of hospital's or surgeon's CABG volume on patient-level outcomes. All of the independent variables included in the patient-level risk adjustment model were included in the hospital and surgeon analyses.

Two definitions of volume were considered for both the hospital and surgeon volume-outcome analyses. First, "isolated CABG volume" was analyzed to assess whether there was an association between isolated CABG volume and isolated CABG mortality. Second, "total CABG volume," which includes both isolated and non-isolated CABG surgeries, was analyzed to assess whether there was an association between total CABG volume and isolated CABG mortality.

---

[14] Peterson ED, Coombs LP, DeLong ER, Haan CK, Ferguson TB. Procedural volume as a marker of quality for CABG surgery. JAMA 2004;291(2):195-201.

[15] Shahian DM, Normand SL, Torchiana DF, Lewis SM, Pastore JO, Kuntz RE, et al. Cardiac surgery report cards: comprehensive review and statistical critique. Ann Thorac Surg 2001;72(6):2155-68.

[16] Glance LG, Dick AW, Mukamel DB, Osler TM. Is the hospital volume-mortality relationship in coronary artery bypass surgery the same for low-risk versus high-risk patients? Ann Thorac Surg 2003;76(4):1155-62.

[17] Parker JP, Li Z, Danielsen B, Marcin J, Dai J, Mahendra G, Steimle AE. ***The California Report on Coronary Artery Bypass Graft Surgery 2003 Hospital Data,*** Sacramento, CA: California Office of Statewide Health Planning and Development, February 2006.

Annualized hospital and surgical volumes were used in these analyses since not every hospital and surgeon conducted CABG procedures during 2003 and 2004. If CABG surgeries were performed in both 2003 and 2004, the two-year average was considered the annualized volume. If CABG surgeries were performed in only one of the two years, the single year's volume was considered the annualized volume.

The first analyses evaluated whether a linear relationship existed between hospital and surgeon CABG volume and mortality. In these analyses, annualized hospital and surgeon volumes (both isolated and total volume) were separately included as continuous independent variables in the hierarchical logistic regression models. Second, to evaluate whether different threshold volumes or volume categories were associated with higher or lower mortality, hospitals and surgeons were grouped into volume categories depending on their annualized number of isolated and total CABG procedures. Then, these hospital and surgeon volume categories were included as indicator variables in separate analyses.

Results

Hospital Volume-Outcome Relationship: The 2003-2004 CCORP CABG database contains detailed patient-level clinical data on 40,377 isolated CABG surgery procedures in 121 hospitals. The average annualized hospital isolated CABG surgery volume was 167 cases, with a range among individual hospitals of 18 to 984. The overall operative mortality rate was 3.08%, and the average annualized hospital operative mortality rate was 3.37%, with a range among individual hospitals of 0% to 12.73%.

In the hierarchical model, when hospital isolated CABG volume was entered into the analysis as a continuous variable, there was no association with risk-adjusted operative mortality (coefficient = -0.006, standard error = 0.025, p-value = 0.808, OR = 0.994, and 95% confidence interval = 0.947-1.043 for every additional 100 patients). Similarly, when hospital total CABG volume was entered into the analysis as a continuous variable, there was no association with risk-adjusted operative mortality (coefficient = -0.008, standard error = 0.020, p-value = 0.704, OR = 0.992, and 95% confidence interval = 0.954-1.031 for every additional 100 patients).

Table 7 presents the summary statistics when annualized hospital isolated CABG volume was categorized into quartiles (<200, 200-299, 300-599, >=600) and dichotomized (>=450 and <450; >=250 and <250; and >=100 and <100). The quartiles were chosen because these volumes were used in the previous California volume-outcome reports. The split point of 450 procedures per year was chosen because of the past volume recommendations by The Leapfrog Group (www.leapfroggroup.org), and the split point of 100 was chosen because of the past volume recommendations by the American College of Cardiology and the American Heart Association (ACC/AHA Practical Guidelines). These data show that patients have a similar risk of dying from a CABG procedure regardless of the hospital's annual volume.

Table 7: Hospital Isolated CABG Volume Groups and Predicted Mortality Outcomes, 2003-2004

Volume Group	Hospitals (n=121) N (%)	Patients (n=40,377) N (%)	OR (95% CI)
>=600	4 (3)	6,538 (16)	0.998 (0.680, 1.466)
300-599	8 (7)	6,379 (16)	1.084 (0.804, 1.458)
200-299	17 (14)	7,920 (20)	0.925 (0.731, 1.172)
<200	92 (76)	19,540 (48)	Reference
>=450	6 (5)	8,687 (22)	0.990 (0.725, 1.353)
<450	115 (95)	31,690 (78)	Reference
>=250	15 (12)	14,552 (36)	1.132 (0.910, 1.408)
<250	106 (88)	25,825 (64)	Reference
>=100	91 (75)	35,474 (88)	0.941 (0.755, 1.173)
<100	30 (25)	4,903 (12)	Reference

Table 8 presents the summary statistics when annualized hospital total CABG volume was categorized into quartiles (<200, 200-299, 300-599, >=600) and dichotomized (>=450 and <450; >=250 and <250; and >=100 and <100). These data also show that patients have a similar risk of dying from a CABG procedure regardless of the hospital's total CABG surgery annual volume.

Table 8: Hospital Total CABG Volume Groups and Predicted Mortality Outcomes, 2003-2004

Volume Group	Hospitals (n=121) N (%)	Patients (n=40,377) N (%)	OR (95% CI)
>=600	5 (4)	7,652 (19)	1.005 (0.714, 1.413)
300-599	12 (10)	7,776 (19)	1.011 (0.783, 1.305)
200-299	22 (18)	8,855 (22)	0.801 (0.639, 1.003)
<200	82 (68)	16,094 (40)	Reference
>=450	8 (7)	10,186 (25)	1.051 (0.797, 1.387)
<450	113 (93)	30,191 (75)	Reference
>=250	26 (21)	19,465 (48)	0.992 (0.820, 1.200)
<250	95 (79)	20,912 (52)	Reference
>=100	91 (75)	37,301 (92)	0.919 (0.711, 1.188)
<100	30 (25)	3,076 (8)	Reference

Surgeon Volume-Outcome Relationship: During 2003 and 2004, 40,377 isolated CABG surgery procedures were conducted by 302 surgeons. The average annualized number of CABG surgeries conducted by surgeons was 69, with a range among individual surgeons of 1 to 345. The overall operative mortality rate was 3.08%, and the average annualized surgeon operative mortality rate was 3.59%, with a range among individual surgeons of 0% to 66.67%.

When surgeon isolated CABG volume was entered into the hierarchical model as a continuous variable, there was no association with risk-adjusted operative mortality (coefficient = -0.052, standard error = 0.040, p-value = 0.138, OR = 0.950, and 95% confidence interval = 0.879-1.027 for every additional 50 patients). When surgeon total CABG volume was entered into the model as a continuous variable, a trend of higher volume and lower risk-adjusted operative mortality resulted but was not statistically significant (coefficient = -0.053, standard error = 0.030, p value = 0.073, OR = 0.948, and 95% confidence interval = 0.895-1.005 for every additional 50 patients).

Table 9 presents the summary statistics when annualized surgeon isolated volume was categorized into quartiles (<25, 25-49, 50-99, >=100) and dichotomized (>=100 and <100; >=50 and <50; and >=25 and <25). The data show that patients have a similar risk of dying from a CABG procedure when operated on by surgeons with lower annual isolated CABG surgery volumes as compared to higher annual isolated CABG surgery volumes.

Table 9: Surgeon Isolated CABG Volume Groups and Predicted Mortality Outcomes, 2003-2004

Volume Group	Surgeons (n=302) N (%)	Patients (n=40,377) N (%)	OR (95% CI)
>=100	65 (22)	19,760 (49)	0.830 (0.552, 1.247)
50-99	105 (35)	15,017 (37)	0.932 (0.623, 1.393)
25-49	68 (23)	4,574 (11)	1.022 (0.664, 1.573)
<25	64 (21)	1,026 (3)	Reference
>=100	65 (22)	19,760 (49)	0.865 (0.726, 1.031)
<100	237 (78)	20,617 (51)	Reference
>=50	170 (56)	34,777 (86)	0.870 (0.711, 1.064)
<50	132 (44)	5,600 (14)	Reference
>=25	238 (79)	39,351 (97)	0.907 (0.613, 1.342)
<25	64 (21)	1,026 (3)	Reference

Table 10 presents the summary statistics when annualized surgeon total CABG volume was categorized into quintiles (<50, 50-99, 100-149, 150-199, >=200) and dichotomized (>=200 and <200; >=150 and <150; >=100 and <100; and >=50 and <50). The data suggest a modest association between higher surgeon total CABG volume and lower risk-adjusted isolated CABG surgery operative mortality. Only one of these analyses demonstrated a statistically significant association, where patients receiving isolated CABG surgery by surgeons conducting more than 100 CABG surgeries per year had lower odds of operative mortality (OR=0.817, 95% CI: 0.693-0.964, p=0.017).

Table 10: Surgeon Total CABG Volume Groups and Predicted Mortality Outcomes, 2003-2004

Volume Group	Surgeons (n=302) N (%)	Patients (n=40,377) N (%)	OR (95% CI)
>=200	19 (6)	8,237 (20)	0.794 (0.567, 1.093)
150-199	22 (7)	6,126 (15)	0.799 (0.580, 1.101)
100-149	58 (19)	11,187 (28)	0.780 (0.599, 1.015)
50-99	93 (31)	10.995 (27)	0.948 (0.738, 1.219)
<50	110 (36)	3,832 (9)	Reference
>=200	19 (6)	8,237 (20)	0.899 (0.691, 1.170)
<200	283 (94)	32,140 (80)	Reference
>=150	41 (14)	14,363 (36)	0.888 (0.728, 1.084)
<150	261 (86)	26,014 (64)	Reference
>=100	99 (33)	25,550 (63)	0.817 (0.693, 0.964)
<100	203 (67)	14,827 (37)	Reference
>=50	192 (64)	36,545 (91)	0.849 (0.676, 1.066)
<50	110 (36)	3,832 (9)	Reference

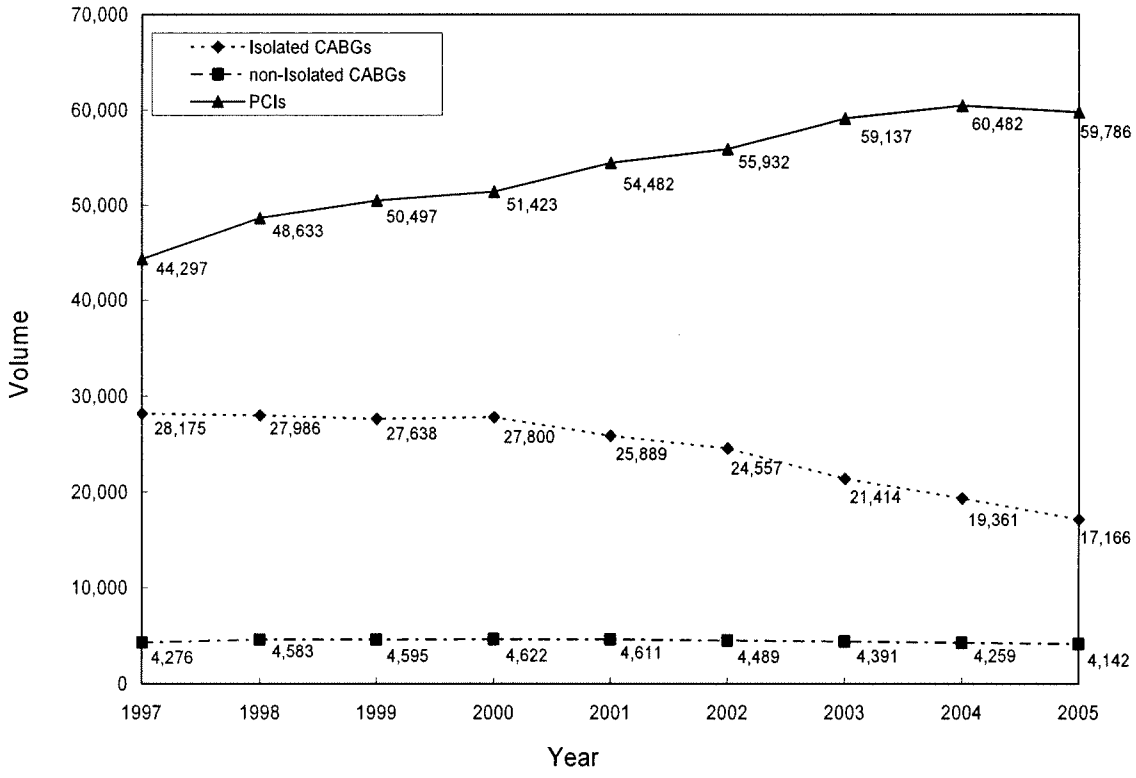
Utilization of Cardiac Intervention Procedures

Isolated CABG volume has declined in recent years while Percutaneous Coronary Intervention (PCI) volume has increased. Nationally, the rate of coronary stent insertion increased by 147% from 1996 to 2000—from 66 per 100,000 cardiac procedures in 1996 to 163 per 100,000 in 2000.[18] As shown in Figure 3, utilization of PCIs in California has grown from 44,297 procedures in 1997 to 59,786 procedures in 2005—an increase of 35%. Meanwhile the number of isolated CABG surgeries has dropped from 28,175 to 17,166—a decrease of 39%. However, non-isolated CABG surgery volume has remained constant at roughly 4,200 cases per year.

Medical innovations such as the CABG procedure, Percutaneous Transluminal Coronary Angioplasty (PTCA), and intra-coronary stents perfected during the past 30 years have contributed to improved survival for heart attack patients. The introduction of the intra-coronary stent insertion procedure (small wire cylinders that hold a narrow artery open) in clogged arteries is rapidly replacing angioplasty without stents because of lower rates of re-narrowing of opened arteries (restenosis) associated with intracoronary stents. New technologies and improved adjunctive medical therapy are making PCI a viable alternative to CABG. The advantages associated with PCI have been widely noted: PCI involves a shorter hospital stay, is suitable for most patients, and can be repeated and performed without anesthesia by a cardiologist or surgeon. On the other hand, the CABG surgery has lower rates of repeat revascularization, less overall angina, and lower long-term mortality. A more comprehensive approach to examining the quality of revascularization procedures in California would include PCI and its outcomes.

[18] Bernstein AB, Hing E, Moss AJ, Allen KF, Siller AB, Tiggle RB. *Health Care in America: Trends in Utilization,* Hyattesville, Maryland; National Center for Health Statistics, 2003.

Figure 3: California Isolated CABG, Non-Isolated CABG, PCI Volume, 1997-2005



APPENDIX A: CLINICAL DEFINITION OF ISOLATED CABG FOR 2003-2004

Definition/Description:
When any of the procedures listed in Section A is performed concurrently with the coronary artery bypass surgery, the surgery will be considered non-isolated and the data element coded "No." It is not possible to list all procedures because cases can be complex and clinical definitions are not always precise. When in doubt, the data abstractor should first seek an opinion from the responsible surgeon and then consult CCORP.

Section A (Excluded):

- Any aortic aneurysm repair (abdominal or thoracic)
- Aorta-iliac-femoral bypass
- Aorta-renal bypass
- Aorta-subclavian-carotid bypass
- Caval-pulmonary artery anastomosis
- Coronary artery fistula
- Endarterectomy of aorta
- Excision of aneurysm of heart
- Extracranial-intracranial (EC-IC) vascular bypass
- Head and neck, intracranial endarterectomy
- Heart transplantation
- Implantation of cardiomyostimulation system (Note: Refers to cardiomyoplasty systems only, not other heart-assist systems such as pacemakers or internal cardiac defibrillators (ICDs))
- Mastectomy for breast cancer (not simple breast biopsy)
- Full surgical Maze procedures. Requires that the left atrium be opened to create the "maze" with incisions. Does not include "mini" Maze procedures limited to pulmonary vein isolation and/or amputation of the left atrial appendage.
- Operations on structures adjacent to heart valves (papillary muscle, chordae tendineae, traebeculae carneae cordis, annuloplasty, infundibulectomy)
- Other open heart surgeries, such as aortic arch repair, pulmonary endarterectomy
- Repair of atrial and ventricular septa, excluding closure of patent foramen ovale
- Repair of certain congenital cardiac anomalies, excluding closure of patent foramen ovale (e.g., tetralogy of fallot, atrial septal defect (ASD), ventricular septal defect (VSD), valvular abnormality)
- Resection of a lobe or segment of the lung (e.g., lobectomy or segmental resection of lung). Does not include simple biopsy of lung nodule in which surrounding lung is not resected, biopsy of a thoracic lymph node, or excision or stapling of an emphysematous bleb.
- Thoracic endarterectomy (endarterectomy on an artery outside the heart)
- Amputation of any extremity (e.g., foot or toe)
- Valve repairs or replacements
- Ventriculectomy

If a procedure listed in Section B is performed concurrently with the coronary artery bypass surgery, the surgery will be considered an isolated CABG and the data element coded "Yes," unless a procedure listed in Section A is performed during the same surgery. These particular

procedures are listed because the Office has received frequent questions regarding their coding.

Section B (Included):

- Coronary endarterectomy
- Internal cardiac defibrillators (ICDs)
- Fem-fem cardiopulmonary bypass (a form of cardiopulmonary bypass that should not be confused with aortofemoral bypass surgery listed in Section A)
- Pacemakers
- Pericardiectomy and excision of lesions of heart
- Repair/restoration of the heart or pericardium
- Transmyocardial laser revascularization (TMR)
- Thymectomy
- Thyroidectomy

APPENDIX B: CCORP DATA ELEMENT DEFINITIONS

Data Element	Definition
Facility Identification Number	The six-digit facility identification number assigned by the Office of Statewide Health Planning and Development.
Isolated CABG: Yes; No.	Answer 'No' if any of the procedures listed below were performed during coronary artery bypass graft surgery. *(See Appendix A for full definition)*
Responsible Surgeon Name (3 separate fields): Surgeon Last Name; Surgeon First Name; Surgeon Middle Initial	Responsible surgeon means the principle surgeon who performs a coronary artery bypass procedure. If a trainee performs this procedure, then the responsible surgeon is the physician responsible for supervising this procedure performed by the trainee. In situations in which a responsible surgeon cannot otherwise be determined, the responsible surgeon is the surgeon who bills for the coronary artery bypass procedure.
Responsible Surgeon CA License Number	California physician license number of responsible surgeon, assigned by the Medical Board of California of the Department of Consumer Affairs.
Medical Record Number	Patient medical record number at the hospital where surgery occurred.
Date of Birth: mm/dd/yyyy	Patient date of birth.
Date of Surgery: mm/dd/yyyy	Patient date of surgery for the CABG procedure.
Date of Discharge: mm/dd/yyyy	Patient date of discharge.
Discharge Status: Alive; Dead.	Patient status upon discharge from the hospitalization in which surgery occurred.
Date of Death: mm/dd/yyyy	Patient date of death.
Race: Caucasian; Black; Hispanic; Asian; Native American; Other.	Patient race or ethnicity.
Gender: Male; Female.	Patient gender.
Patient Age (calculated)	Patient age in years, at time of surgery. This should be calculated from the Date of Birth and

Data Element	Definition
	the Date of Surgery, according to convention used in the USA (the number of birth date anniversaries reached by the date of surgery).
Height: Real number 3.2 digits (e.g., 999.99)	Height of the patient in centimeters. Valid values are between 20 and 251 cm.
Weight: Real number 3.2 digits (e.g., 999.99)	Weight of the patient in kilograms. Valid values are between 10 and 250 kg.
Status of the Procedure: Emergent/Salvage; Emergent; Urgent; Elective.	The status that best describes the clinical status of the patient at the time of surgery. **Emergent/Salvage:** The patient is undergoing cardiopulmonary resuscitation en route to the operating room or prior to anesthesia induction. **Emergent:** The patient's clinical status includes any of the following: a. Ischemic dysfunction (any of the following): (A) Ongoing ischemia including rest angina despite maximal medical therapy (medical and/or intra-aortic balloon pump (IABP)); (B) Acute Evolving Myocardial Infarction within 24 hours before surgery; or (C) pulmonary edema requiring intubation. b. Mechanical dysfunction (either of the following): (A) shock with circulatory support; or (B) shock without circulatory support. **Urgent:** ALL of the following conditions are met: a. Not elective status b. Not emergent status c. Procedure required during same hospitalization in order to minimize chance of further clinical deterioration. d. Worsening, sudden chest pain; congestive heart failure (CHF); acute myocardial infarction (AMI); coronary anatomy; (IABP); unstable angina (USA) with intravenous (IV) nitroglycerin; rest angina, valve dysfunction; or aortic dissection. **Elective:** The patient's status has been stable in the days or weeks prior to the operation. The procedure could be deferred without increased risk of compromised cardiac outcome.
Last Creatinine Level Preop (mg/dl): Real number 2.1 digits (e.g., 99.9)	The most recent creatinine level prior to surgery. A creatinine level should be collected on all patients for consistency, even if they have no prior history. Valid values are between 0.1 and 30 mg/dl.
Dialysis: Yes; No.	The patient is on dialysis preoperatively.
Diabetes: Yes; No.	The patient has a history of diabetes, regardless

Data Element	Definition
	of duration of disease or need for anti-diabetic agents.
Peripheral Vascular Disease: Yes; No.	The patient has a history at any time prior to surgery of Peripheral Vascular Disease, as indicated by claudication either with exertion or rest; amputation for arterial insufficiency; aorto-iliac occlusive disease reconstruction; peripheral vascular bypass surgery, angioplasty, or stent; documented abdominal aortic aneurysm (AAA), AAA repair, or stent; positive non-invasive testing documented. Excludes Cerebrovascular Disease.
Cerebrovascular Disease: Yes; No.	The patient has a history at any time prior to surgery of Cerebrovascular Disease, documented by any one of the following: unresponsive coma > 24 hours; cerebrovascular accident (CVA) (symptoms > 72 hours after onset); reversible ischemic neurological deficit (RIND) (recovery within 72 hours of onset); transient ischemic attack (TIA) (recovery within 24 hours of onset); non-invasive carotid test with > 75% occlusion; or prior carotid surgery.
Cerebrovascular Accident: Yes; No.	The patient has a history, at any time prior to surgery, of a central neurologic deficit persisting more than 72 hours. (i.e., extremity weakness or loss of motion, loss of consciousness, loss of speech, field cuts). Chart documentation of a prior diagnosis of CVA or stroke is sufficient.
Cerebrovascular Accident Timing: Recent (<=2 weeks); Remote (>2 weeks).	Events occurring within two weeks of the surgical procedure are considered recent; all others are considered remote.
Chronic Lung Disease: No; Mild; Moderate; Severe.	Specify if the patient has chronic lung disease and the severity level according to the following classification: **No**: No chronic lung disease present. **Mild**: Forced expiratory volume in one second (FEV1) 60% to 75% of predicted, and/or on chronic inhaled or oral bronchodilator therapy. **Moderate**: FEV1 50-59% of predicted, and/or on chronic steroid therapy aimed at lung disease. **Severe**: FEV1 <50% predicted, and/or room air partial pressure of oxygen (pO2) < 60 or room air partial pressure of carbon dioxide (pCO2) > 50.
Hypertension: Yes; No.	The patient has a diagnosis of hypertension, documented by one of the following: a.

Data Element	Definition
	Documented history of hypertension diagnosed and treated with medication, diet and/or exercise. b. Blood pressure > 140 systolic or > 90 diastolic on at least 2 occasions. c. Currently on antihypertensive medication.
Immunosuppressive Treatment: Yes; No.	Patient has used any form of immunosuppressive therapy (i.e., systemic steroid therapy) within 30 days preceding the operative procedure. Does not include topical applications and inhalers.
Hepatic Failure: Yes; No.	The patient has cirrhosis, hepatic failure, acute hepatitis or "shock liver" and has a bilirubin greater than 2 mg/dl and a serum albumin less than 3.5 grams/dl.
Arrhythmia: Yes; No.	A preoperative arrhythmia present within two weeks of the procedure, by clinical documentation of any one of the following: Atrial fibrillation/flutter requiring medication; Heart block; Sustained Ventricular Tachycardia; or Ventricular Fibrillation requiring cardioversion and/or intravenous amiodarone.
Arrhythmia Type: Sust VT/VF; Heart Block; AFib/Flutter.	The type of arrhythmia is present within two weeks of the procedure is: Sustained Ventricular Tachycardia or Ventricular Fibrillation requiring cardioversion and/or intravenous amiodarone; Heart Block; and Atrial fibrillation/flutter requiring medication.
Myocardial Infarction: Yes; No.	Refers to any myocardial infarction (MI) in the past. **For MIs prior to the current hospitalization** for which detailed records are not available, chart documentation in which a clinician caring for the patient diagnosed an MI is sufficient. **For MIs during the current hospitalization** for which detailed records are available, conditions A and B below must all be met: A) The patient must have been diagnosed with a myocardial infarction (ST elevation or non ST elevation) by a clinician caring for patient. B) At least 1 of the 3 following biochemical indicators for detecting myocardial necrosis must be present: 1) Troponin T or I: a. Maximal concentration of troponin T or I exceeding the MI diagnostic limit (99th percentile of the values for

Data Element	Definition
	a reference control group, as defined in section C) on at least one occasion during the first 24 hours after the index clinical event. 2) CK-MB: a. Maximal value of CK-MB more than two times the upper limit of normal on at least one occasion during the first 24 hours after the index clinical event. b. Maximal value of CK-MB, preferable CK-MB mass, exceeding 99th percentile of the values for a reference control group, as defined in section C, on two successive samples during the first 24 hours after the index clinical event. 3) Total CK: a. In the absence of availability of a troponin or CK-MB assay, total CK more than two times the upper limit of normal (99th percentile of the values for a reference control group, as defined in *), or the B fraction of CK may be employed, but these last two biomarkers are considerably less satisfactory than CK-MB. * Reference control values (MI diagnostic limit and upper limit of normal): 1) Reference values must be determined in each laboratory by studies using specific assays with appropriate quality control, as reported in peer-reviewed journals. Acceptable imprecision (coefficient of variation) at the 99th percentile for each assay should be defined as less than or equal to 10 percent. Each individual laboratory should confirm the range of reference values in their specific setting.
Myocardial Infarction Timing: <=6 Hrs; >6 Hrs but <24 Hrs; 1 to 7 Days; 8 to 21 Days; >21 Days.	Time period between the last documented myocardial infarction and the CABG surgery.
Cardiogenic Shock: Yes; No.	The patient, at the time of procedure, is in a clinical state of hypoperfusion according to either of the following criteria: 1. Systolic blood pressure (BP) < 80 mm hg and/or Cardiac Index (CI) < 1.8 despite maximal treatment. 2. Intravenous inotropes and/or intra-aortic balloon pump (IABP) necessary to maintain Systolic BP > 80 mm hg and/or CI > 1.8.
Angina: Yes; No.	The patient has ever had angina pectoris.
Angina Type: Stable; Unstable.	The type of angina present within 24 hours prior to CABG surgery is: Stable: Angina not meeting unstable criteria below. Unstable: Requires continuous hospitalization from the episode until surgery and one of the following: 1) Angina at

Data Element	Definition
	rest. 2) New onset angina in past 2 months of at least Canadian Cardiovascular Society (CCS) Class III. 3) Increasing angina in past 2 months - angina that has become more frequent, longer in duration, or lower in threshold; and increased by greater than or equal to 1 CCS class to at least CCS Class III severity.
CCS Classification: No Angina = Class 0; Class I; Class II; Class III; Class IV.	Canadian Cardiovascular Society (CCS) Classification. This classification represents level of functional status related to frequency and intensity of angina. The CCS may not be the same as the NYHA classification for the same evaluation time period. Code the highest class leading to episode of hospitalization and/or intervention: **0**=No angina. **I**= Ordinary physical activity, such as walking or climbing the stairs does not cause angina. Angina may occur with strenuous, rapid or prolonged exertion at work or recreation. **II**= There is a slight limitation of ordinary activity. Angina may occur with moderate activity such as walking or climbing stairs rapidly, walking uphill, walking or stair climbing after meals or in the cold, in the wind, or under emotional stress, or walking more than two blocks on the level, and climbing more than one flight of stairs at normal pace under normal conditions. **III**= There is marked limitation of ordinary physical activity. Angina may occur after walking one or two blocks on the level or climbing one flight of stairs under normal conditions at a normal pace. **IV**= There is inability to carry on any physical activity without discomfort; angina may be present at rest.
Congestive Heart Failure: Yes; No.	The patient has symptoms that occurred within 2 weeks prior to surgery. This does not include patients with chronic or stable non-symptomatic compensated congestive heart failure (CHF). The patient has one or more of the following: Paroxysmal nocturnal dyspnea (PND), Dyspnea on exertion (DOE) due to heart failure, Chest X-Ray (CXR) showing pulmonary congestion; and Pedal edema or dyspnea and receiving diuretics or digoxin.
NYHA Classification: Class I; Class II; Class III; Class IV.	New York Heart Association (NYHA) Classification represents the overall functional

Data Element	Definition
	status of the patient in relationship to both congestive heart failure and angina. The NYHA may not be the same as the CCS classification for the same evaluation period. Code the highest level leading to episode of hospitalization and/or procedure: **I**= Patients with cardiac disease but without resulting limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or anginal pain. **II**= Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain. **III**= Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary physical activity results in fatigue, palpitations, dyspnea, or anginal pain. **IV**= Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or of the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.
Number of Prior Cardiac Operations Requiring Cardiopulmonary Bypass	Prior to this operation, the number of cardiac surgical operations performed on this patient utilizing cardiopulmonary bypass. Valid values are between 0 and 9.
Number of Prior Cardiac Operations Without Cardiopulmonary Bypass	Prior to this operation, the number of cardiac surgical operations performed on this patient without cardiopulmonary bypass. Valid values are between 0 and 9.
Prior PCI: Yes; No.	Percutaneous coronary intervention (PCI) was done at any time prior to this surgical procedure (which may include during the current admission). PCI includes percutaneous transluminal coronary angioplasty (PTCA), intracoronary fibrinolysis without PTCA, laser recanalization, stent implantation, rheolysis with angiojet, brachytherapy, and other catheter-based percutaneous recanalization techniques.
Interval from prior PCI to Surgery: <=6 Hrs; > 6 Hrs.	The time between prior percutaneous coronary intervention (PCI) and surgical repair of coronary occlusion:<=6 hours; > 6 hours.

Data Element	Definition
Ejection Fraction (%): Integer length 2	The percentage of blood emptied from the ventricle at the end of the contraction. Use the most recent determination prior to intervention. Enter a percentage in the range of 5-90.
Ejection Fraction Method: LV Gram; Radionucleotide; Estimate; ECHO.	Method of obtaining ejection fraction measurement information: **LV Gram:** Left Ventriculogram. **Radionucleotide:** MUGA Scan. **Estimate:** From other calculations, based upon available clinical data. **ECHO:** Echocardiogram.
Left Main Disease (% Stenosis): Integer length 3	Percentage of compromise of vessel diameter in any angiographic view. Valid values are between 0 and 100.
Number of Diseased Coronary Vessels: None; One; Two; Three.	The number of major coronary vessel systems (Left anterior descending (LAD) system, Circumflex system, and/or Right system) with >50% narrowing in any angiographic view. NOTE: Left main disease (>50%) is counted as TWO vessels (LAD and Circumflex). For example, left main and right coronary artery (RCA) would count as three total.
Mitral Insufficiency: None; Trivial; Mild; Moderate; Severe.	Indicate if there is evidence of mitral valve regurgitation and if so, the severity level.
Internal Mammary Artery(ies) Used as Grafts: Left IMA; Right IMA; Both IMAs; No IMA.	Internal Mammary Artery(ies) (IMA) used for grafts, if any.
Cardiopulmonary Bypass Used: Yes; No.	Use of Cardiopulmonary Bypass (CPB) at any time during the procedure.
Conversion to Cardiopulmonary Bypass: Yes; No.	The patient needed to be placed on cardiopulmonary bypass (CPB) after the off-pump procedure was attempted.
Primary Incision: Full Sternotomy; Partial Sternotomy; Transverse Sternotomy; Right Vertical Parasternal; Left Vertical Parasternal; Right Anterior Thoracotomy; Left Anterior Thoracotomy; Posterolateral Thoracotomy; Xiphoid; Epigastric; Subcostal.	The primary incision used as the initial intention for treatment.
Cardioplegia: Yes; No.	Cardioplegia was used.

APPENDIX C: HOSPITAL RESPONSES

Each of the hospitals included in the CCORP 2003-2004 report was provided with a preliminary report containing the risk-adjustment model and outcome results and allowed a 60-day review period for submitting statements to OSHPD. Letters were received from two hospitals and they are included in this appendix. The hospital comments have been summarized into the following categories:

1. Risk-adjustment methodology

Comment:

One hospital raised concerns regarding the methodology used for risk adjustment. The hospital listed cases where the death of the patient was attributed to the presence of end-stage lung disease, end-stage renal disease, and end-stage ischemic cardiomyopathy combined with congestive heart failure. According to the hospital, these patients did not die as a result of the CABG surgery.

Response:

The CCORP report uses a risk-adjustment methodology that takes into account the pre-operative risk factors reflecting severity of illness and risk of mortality for each patient. The presence of end-stage lung disease, renal disease, or congestive heart failure is captured by risk factors such as chronic lung disease, creatinine level, and congestive heart failure. Although not all possible risk factors can be included in the model, CCORP includes the risk factors that are included by STS and other similar programs. The CCORP risk model provides appropriate adjustments to hospitals that treat severely ill patients.

2. Operative mortality

Comment:

A hospital raised concerns about the CCORP definition of mortality. The author noted that this definition of mortality penalizes hospitals that do not transfer their CABG surgery patients to other facilities after 30 days. Patients who are transferred to another facility and expire after 30 days are not counted as deaths, whereas patients who are not transferred and expire after 30 days are counted as deaths.

Response:

CCORP uses operative mortality (patient death occurring in the hospital after CABG surgery, regardless of the length of stay or death occurring anywhere after hospital discharge, but within 30 days of the CABG surgery) as the outcome measure. Patient death is confirmed by linking CCORP data with the state death file provided by the California Department of Health Services. If a patient is transferred to another institution and dies there within 30 days after the surgery, the death is captured by this linkage. Using operative mortality helps avoid some potential "gaming" of outcomes through discharge practices though patients who are transferred 30 days after the operation and die in other facilities are not included in the mortality count. While

another measure could be used, CCORP decided to align its quality measure with the National Society for Thoracic Surgery (STS) which also uses operative mortality as their primary outcome measure for CABG quality reporting.

3. Consistency in coding

Comment:

Another concern was raised about the variation in coding of the risk factors, which can affect the validity of risk-adjusted results. Specifically, overstating the risk profiles of patients may provide an unfair advantage to some hospitals. In addition, the hospital mentioned that potentially difficult-to-measure risk factors not included in the current model may increase or decrease a patient's risk of an adverse outcome.

Response:

When this program first began, all hospital staff involved in abstracting surgical data were offered in-person instruction by the CCORP consulting cardiologist and training videos of these sessions were later distributed. Hospitals were also provided with a data abstractor's manual that clearly defines the data elements and the coding structure. For difficult to code elements, CCORP offers further information on the OSHPD Web site and refers unique cases to the consulting cardiologist. CCORP data for 2003 and 2004 were also subjected to medical chart review. The primary candidates for data audit were hospitals and surgeons identified as outliers on a preliminary basis, near outliers, or hospitals/surgeons with apparent over-reporting or under-reporting of risk factors. Audit data replaced the data submitted from the hospitals. The medical chart review, along with other analyses and data quality reports ensures the fairness of risk factor coding across hospitals. Information about the medical chart audit process is provided in Section III.

4. Combining years of data

Comment:

A hospital expressed concern about reporting separate results for individual years and combined years. The hospital believes caution should be used in interpretation of the mortality statistics.

Response:

CCORP reported hospital level data for 2003-2004 combined and 2004 separately in this report. The combined year data allows for direct comparison to the 2003-2004 surgeon level results. The two-year combined results are statistically more stable than the results from a single year of data, especially for lower volume hospitals. However, the 2004 data allows readers to see the most current performance and to observe any changes from the 2003 hospital level results previously reported.

5. Use of the Internal Mammary Artery (IMA)

Comment:

One hospital commented on the absence of consensus on what constitutes an unacceptably low level of IMA usage. However, the hospital does recognize the current endorsement, by groups like Leapfrog, National Quality Forum, Society for Thoracic Surgeons and programs like CCORP in regard to the importance of IMA usage for CABG surgeries. This hospital also stated that during the past 18 months IMA usage for CABG surgeries at their facility has significantly increased.

Response:

According to the STS, the internal mammary artery confers long-term graft patency and improves patient survival as compared to surgical revascularization with venous conduits alone. Despite these advantages there is great variability in its application. The main goal of public reporting of IMA usage rates is to encourage hospitals and surgeons to consider the IMA when appropriate. Absent clinical consensus on what constitutes an unacceptably low level of IMA usage, this report adopted a statistical one. CCORP encourages all hospitals and surgeons to make efforts to increase IMA usage rates.

The hospital letters received in response to this report follow.

St. Jude Medical Center

August 29, 2006

Holly Hoegh, Ph.D.
Manager, Clinical Data Programs
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Dear Dr. Hoegh.

St. Jude Medical Center (SJMC) is one of Orange County's most respected hospitals, which ensures our patients receive superior care at every step, including expert physicians, advanced practice nurses, a state-of-the-art intensive care unit, and comprehensive rehabilitation programs.

St. Jude Medical Center appreciates the efforts of the California CABG Outcomes Reporting Program (CCORP) and the opportunity to respond with comment regarding the results of Internal Mammary Artery (IMA) usage in this most recent report.

As stated in the section of this year's CCORP report, Use of Internal Mammary Artery in CABG Surgery as a Process Measure of Quality, there is an "Absent consensus on what constitutes an unacceptably low level of IMA usage". However, St. Jude Medical Center recognizes the current endorsement of the California CABG Outcomes Reporting Program (CCORP), the Leapfrog Group, the National Quality Forum, and the Society of Thoracic Surgeons in regards to the importance of IMA usage for the CABG patient.

Appreciating that our facility's use of internal mammary artery use in CABG surgery could be higher and our commitment to continuous quality improvement, St. Jude Medical Center has implemented processes which detail the importance of considering IMA usage for patients undergoing CABG surgery. During the past 18 months, our facility's IMA usage for patients has significantly increased. Referring to the most recent Society of Thoracic Surgeons (STS) National Database Report - Spring 2006, our facility's IMA usage was 92.2% for 2005. In addition, review of more recent internal data shows that IMA usage for St. Jude Medical Center is 93.1% for January through June 2006.

St. Jude Medical Center is dedicated to continually improving the health and quality of life of people in the communities we serve through our core values of dignity, service, excellence and justice. We look forward to our continued participation in the California CABG Outcomes Reporting Program (CCORP).

Thank you for the opportunity to respond to the 2003-2004 California CABG Outcomes Reporting Program (CCORP) Report.

Best regards,

Doreen L. Dann
Executive Vice President and Chief Operating Officer

University of California
San Francisco
UCSF
Department of Surgery
Division of Cardiothoracic Surgery

Scot H. Merrick, M.D.
Professor of Surgery
Thoracic Surgery Program Director
[illegible]

August 31, 2006

Holly Hoegh, Ph.D.
Manager, Clinical Data Programs
Office of Statewide Health Planning and Development
818 K Street, Room 200
Sacramento, CA 95814

Re: 2003-2004 California CABG Outcomes Reporting Program Report

Dear Ms. Hoegh,

The Division of Cardiothoracic Surgery at the University of California, San Francisco was one of the first groups to provide open-heart surgery in the state of California. The Division, along with the UCSF Medical Center are committed to providing excellence in all aspects of cardiovascular care. Surgery for coronary artery disease is no exception.

The UCSF Medical Center has participated in the state reporting of coronary artery surgery since 1999. As you know, only a minority of cardiac surgery practices reported on a voluntary basis at that time. In the 3 voluntary public reports issued by CCMRP from 1999 through 2002, UCSF consistently scored "as expected" for risk adjusted mortality in coronary artery surgery. In 2003, state law mandated public reporting of coronary artery surgery results for all centers providing this service. Again, in the 2003 public report, the UCSF Medical Center scored "as expected". The 2003-2004 California CABG Outcomes Reporting Program (CCORP) Preliminary Report will be made public shortly. In that report, the UCSF Medical Center along with one of its cardiac surgeons will be listed as "worst than expected" for risk adjusted coronary artery bypass graft mortality. We believe that this designation is not an accurate reflection of the excellence of care here at UCSF for the following reasons:

1. The CCORP risk stratification methodology cannot adequately capture the risk profile of some of our patients. This is exemplified by one patient at UCSF who underwent coronary bypass surgery who had end stage lung disease. This patient was on the waiting list for lung transplantation. The patient recovered uneventfully from his coronary bypass procedure and was discharged home. Unfortunately, the patient developed progression of his severe underlying lung disease and refused further care. He expired of complications related to his underlying end stage lung disease.

University of California
San Francisco
UCSF
Department of Surgery
Division of Cardiothoracic Surgery

Scot H. Merrick, M.D.
Professor of Surgery
Thoracic Surgery Program Director
350 Parnassus Avenue
Suite 706
San Francisco, CA 94143-0118
tel 415/353-1xxx
fax 415/353-xxxx
www.cts.surgery.ucsf.edu

A second patient underwent coronary artery bypass surgery with underlying end stage renal disease. This patient recovered uneventfully from the surgical operation and was discharged home. The patient subsequently died as a result of complications from hemodialysis, not from her cardiac disease.

A third patient who was admitted to the UCSF Medical Center with end stage ischemic cardiomyopathy and congestive heart failure. He was being considered for heart transplantation. After considerable discussion with our cardiovascular experts, coronary bypass surgery was recommended. The patient had a successful operation. However, he continued to have persistent severe heart failure postoperatively. He was placed on a ventricular assist device and was awaiting transplantation. The patient expired as a result of a stroke while on the ventricular assist device.

2. The CCORP reporting mechanism penalizes those hospitals that keep complicated coronary artery bypass patients within their institution for more than 30 days. Should these patients subsequently expire after 30 days, they are counted in the mortality statistics. However, if the patient is transferred to another facility at any point in time, the mortality is not noted under the CCORP Program. Again, UCSF has steadfastly maintained a dedication to uninterrupted care of heart surgery patients.

3. There are significant issues with the CCORP statistical methodology. Excerpts from a statement from the Society of Thoracic Surgeons national cardiac surgery data base report is appropriate here. "The validity of risk adjusted results relies on consistent and accurate coding of risk factors and surgical outcomes. In reality, there may be some variation in the way risk factors and outcomes are coded by two different participants. If one hospital tends to overstate the risk profiles of its patients while another hospital understates the risk profiles of its patients, the hospital that overstates the risk profiles will have an unfair advantage. To minimize bias, it is essential to pay close attention to it to data definitions when coding events and risk factors." Furthermore, the STS also states "not all risk factors are captured in the model. Risk adjustment attempts to level the playing field by adjusting for risk profiles of the participant's patient population. However, there are potentially difficult to measure factors that are not included in the risk assessment model which may increase or decrease a patients' risk of an adverse outcome. For this reason, two patients having exactly the same measured risk factors prior to surgery,

University of California
San Francisco
UCSF
Department of Surgery
Division of Cardiothoracic Surgery

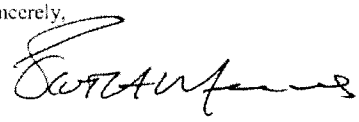
Scot H. Merrick, M.D.
Professor of Surgery
Thoracic Surgery Program Director
350 Parnassus Avenue
Suite 910
San Francisco, CA 94143-0118
tel: 415 353 1816
fax: 415 353 1792
www.cardiacsurgery.ucsf.edu

might actually have substantially different real risk. If a participant tends to treat patients that are at greater or lower risks that they might appear based on the measured risk factors, this may bias their risk-adjusted results upward or downward." As you know, CCORP performed a data audit for the 2004 report. Forty hospitals were selected, including the University of California, San Francisco. The results of that audit revealed that 10.8 % of the categorical risk factors required correction. Moreover, 4.7 % of the categorical risk factors were over coded (risk factor coded more severely by hospital than by audited data) and 4.9% of categorical risk factors were under coded. Based on these statistical limitations, we believe that great caution should be used in the interpretation of mortality statistics.

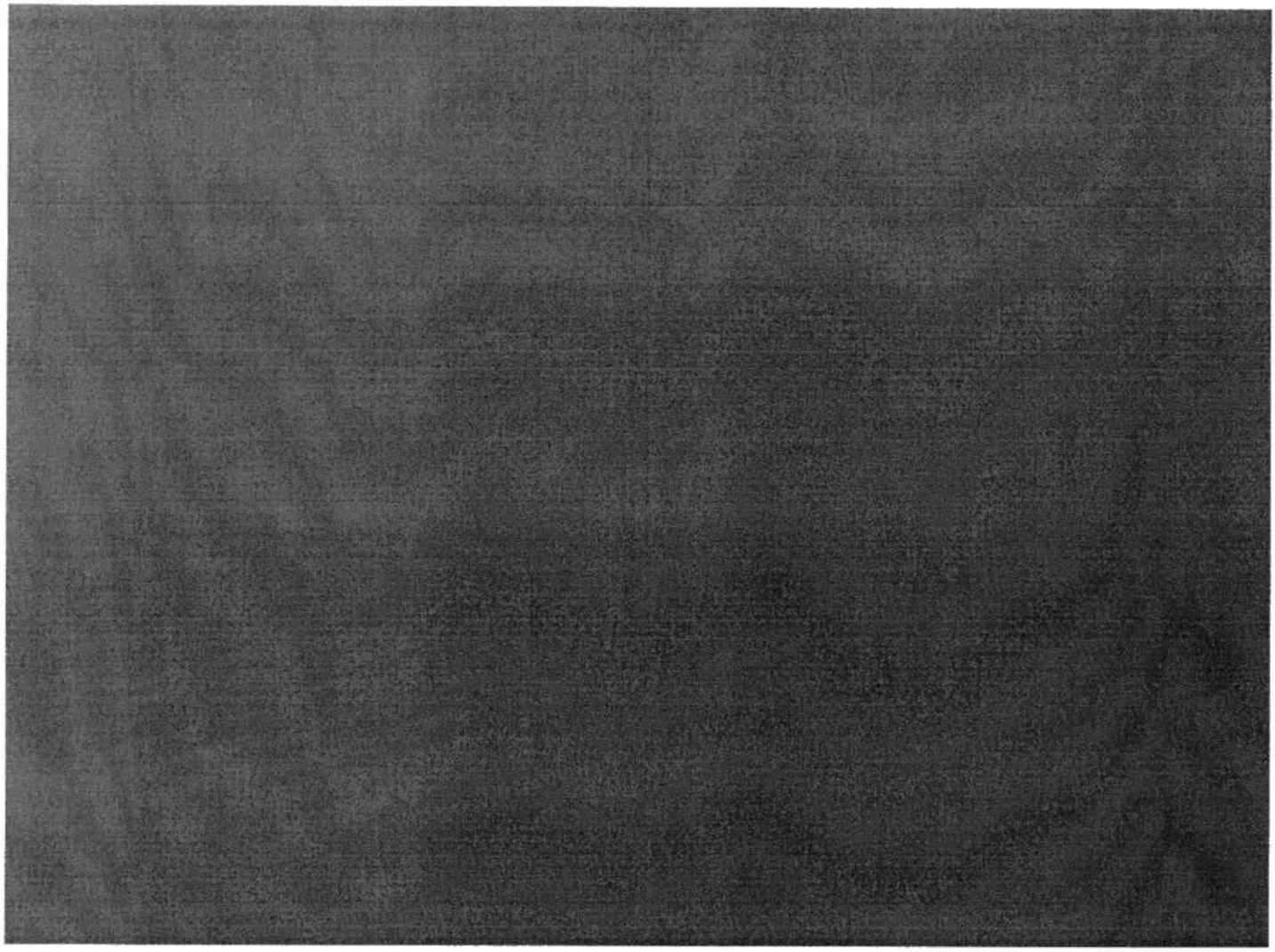
4. We believe that the 2003-2004 California CABG Outcomes Reporting Program Report final report is also misleading in that it includes data from both 2003 and 2004. As mentioned previously, the 2003 CCORP published report for the UCSF Medical Center shows that we had an "as expected" designation for risk stratified CABG mortality. While our risk adjusted mortality for 2004 is "worse than expected", we feel that reporting our results for both years as "worse than expected" is not appropriate.

In summary, the Division of Cardiothoracic Surgery and Medical Center at the University of California, San Francisco, is dedicated to excellence in the care of patients with cardiovascular diseases, and we do not feel that the 2003-2004 CCORP report accurately reflects our practice here at UCSF. We would like to emphasize that the 2005 CCORP Hospital Data Summary Report for the UCSF Medical Center shows an unadjusted CABG mortality of 0.8%. In addition, for the first six months of 2006, the unadjusted operative mortality for CABG was 1.4%. We believe that these results along with our past-published CABG mortality reports are a more accurate reflection of the excellence in care at UCSF.

Sincerely,



Scot H. Merrick, MD
Professor and Chief
Division of Cardiothoracic Surgery



March 2007

Additional copies of The California Report on Coronary Artery Bypass Graft Surgery can be obtained by contacting HIRC at (916) 322-2814 or HIRC@oshpd.ca.gov